

a gateway, switch, router, Internet, Public Switched Telephone Network (PSTN), network nodes **120**, other core network nodes **130**, etc.

**[0087]** Processor **1120** includes any suitable combination of hardware and software implemented in one or more modules to execute instructions and manipulate data to perform some or all of the described functions of core network node **120**. In some embodiments, processor **1120** includes, for example, one or more computers, one or more central processing units (CPUs), one or more microprocessors, one or more applications, and/or other logic.

**[0088]** Memory **1130** is generally operable to store instructions, such as a computer program, software, an application including one or more of logic, rules, algorithms, code, tables, etc. and/or other instructions capable of being executed by a processor. Examples of memory **1130** include computer memory (for example, Random Access Memory (RAM) or Read Only Memory (ROM)), mass storage media (for example, a hard disk), removable storage media (for example, a Compact Disk (CD) or a Digital Video Disk (DVD)), and/or or any other volatile or non-volatile, non-transitory computer-readable and/or computer-executable memory devices that store information.

**[0089]** In some embodiments, network interface **1140** is communicatively coupled to processor **1120** and may refer to any suitable device operable to receive input for core network node **130**, send output from core network node **130**, perform suitable processing of the input or output or both, communicate to other devices, or any combination of the preceding. Network interface **1140** includes appropriate hardware (e.g., port, modem, network interface card, etc.) and software, including protocol conversion and data processing capabilities, to communicate through a network.

**[0090]** Other embodiments of core network node **130** include additional components (beyond those shown in FIG. **11**) responsible for providing certain aspects of the core network node's functionality, including any of the functionality described above and/or any additional functionality (including any functionality necessary to support the solution described above).

**[0091]** Some embodiments of the disclosure may provide one or more technical advantages. For example, certain embodiments may reduce energy consumption by sharing radio unit hardware among cell sectors of a network node. Specifically, one or more radio units under reduced or no load conditions may be shared with other cell sectors in the same network node. In certain embodiments, MIMO and CDD configurations may be dynamically tuned. For example, a network node may be dynamically switched from a MIMO configuration to a SISO or SIMO configuration based on user load and current quality of service requirements.

**[0092]** Another technical advantage may be that operational expenses may be significantly reduced through energy saving and resource sharing. In certain embodiments, low load and no load cell sectors may be identified for resource sharing to reduce energy consumption. In certain embodiments, the Self Organizing Network (SON) Energy Saving function may be optimized to enable resource sharing based on active cell load while maintaining the same radio coverage with no compromise on live traffic capacity.

**[0093]** Another technical advantage may be that the determination that resource sharing should be implemented may be made based on the loading of the cell sectors in combination with user-defined thresholds. Additionally, the SON

algorithm may be optimized to optionally check for PCI confusion and/or prevent maximum limits for cell neighbors from being exceeded prior to enabling radio unit sharing. If any such confusion exists or if maximum limits are exceeded, the radio unit services may not be shared.

**[0094]** Still another technical advantage may be that basic radio coverage may be provided with reduced radio throughput capacity. Energy consumption by multiple radio units may be optimized when radio unit capacity is no longer needed. Each cell sector within a network node may alternate between normal operating mode and a resource sharing/energy saving modes based on instantaneous demand. However, still another technical advantage may be that deactivated radio units may be reactivated as needed based on cell sector load.

**[0095]** Still another technical advantage may be that shared resources can be used to restore coverage loss where radio unit hardware can be lent or otherwise donated when a radio unit fails. In certain embodiments, the MIMO switching decision may be made by the optimized SON algorithm to avoid single point failure in the case of a faulty radio unit. As a result, sector coverage may not be lost and faulty equipment can be replaced during off-peak hours. Another technical advantage may be that operating a radio unit in a resource sharing mode may increase cell availability and reduce power consumption if the radio unit is also operating in a load balancing mode.

**[0096]** Modifications, additions, or omissions may be made to the methods disclosed herein without departing from the scope of the invention. The methods may include more, fewer, or other steps. Additionally, steps may be performed in any suitable order.

**[0097]** Although this disclosure has been described in terms of certain embodiments, alterations and permutations of the embodiments will be apparent to those skilled in the art. Accordingly, the above description of the embodiments does not constrain this disclosure. Other changes, substitutions, and alterations are possible without departing from the spirit and scope of this disclosure, as defined by the following claims.

**[0098]** Abbreviations used in the preceding description include:

- [0099]** UE: User Equipment
- [0100]** PCI: Physical Cell ID
- [0101]** OSS-RC: Operation Sub System-Radio and Core
- [0102]** RBS: Radio Base Station
- [0103]** BW: Bandwidth
- [0104]** MIMO: Multiple Input Multiple Output
- [0105]** SISO: Single Input Single Output
- [0106]** SIMO: Single Input Multiple Output
- [0107]** PRB: Physical Resource Block
- [0108]** SON: Self Organizing Network
- [0109]** CDD: Cyclic Delay Diversity

**1.** A network node for reducing power consumption, comprising:

- a transceiver comprising a plurality of radio units; one or more processors; and
- a non-transitory computer-readable storage medium further including computer-readable instructions that, when executed by the one or more processors, are configured to:
  - determine that physical resource block utilization by a first radio unit is less than a predefined threshold;